Quality.Together

SPIB Subscriber Meeting
October 14, 2021

Update on Southern Pine Design Values

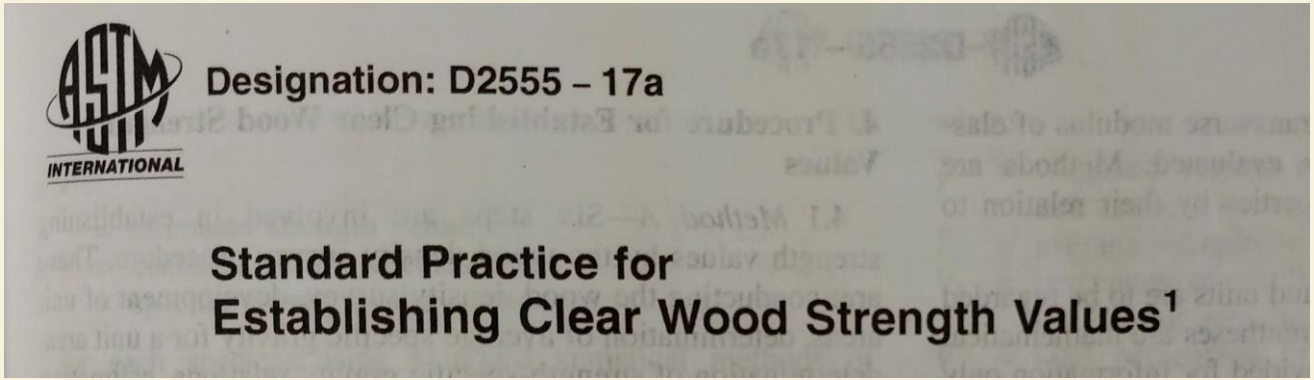
Topics

- Original Design Value Basis
- In-Grade testing
- Monitoring
- New In-Grade Testing
- Monitoring Results

Original Design Value Basis

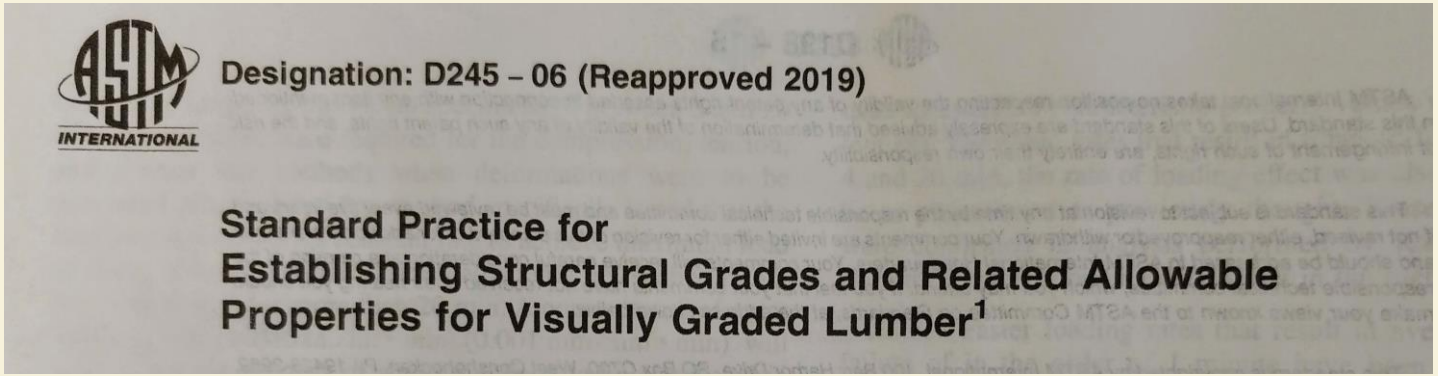
- Small, clear samples
- Tested for Bending, Stiffness, Compression, and Shear strength
- Tension strength was modeled from Bending
- Species values are volume-weighted for four southern pines

Original Design Value Basis



Designation: D2555 – 17a

Standard Practice for
Establishing Clear Wood Strength Values[1]



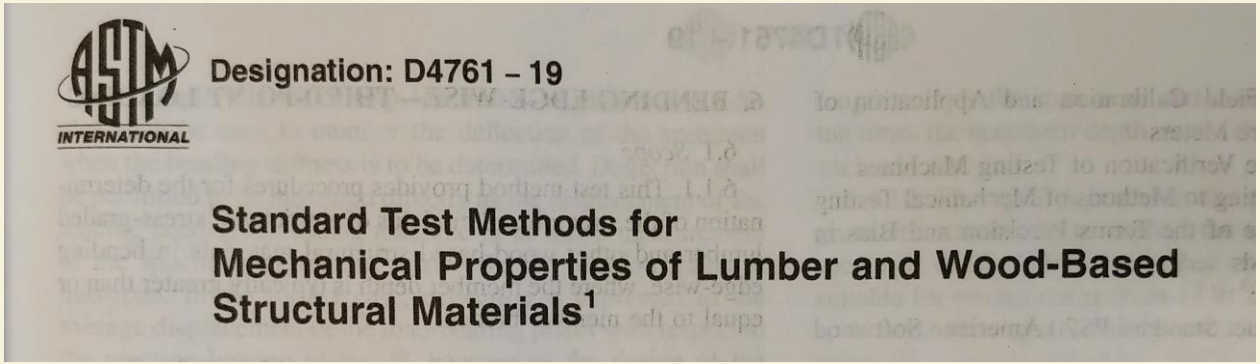
Designation: D245 – 06 (Reapproved 2019)

Standard Practice for
Establishing Structural Grades and Related Allowable
Properties for Visually Graded Lumber[1]

In-Grade Testing

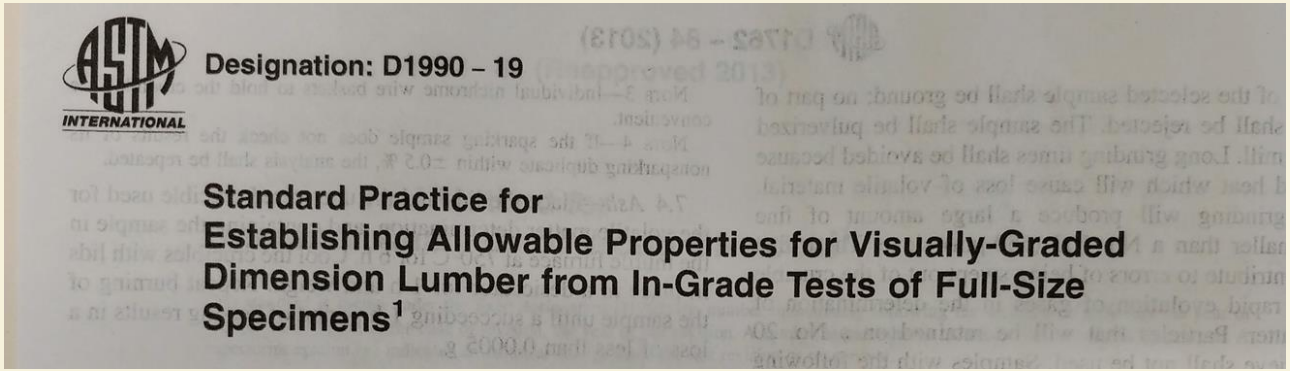
- Testing equipment evolved
- Compare design values to strength of graded lumber
- Testing conducted in 1970s and 1980s

In-Grade Testing Standards



Designation: D4761 – 19

Standard Test Methods for
Mechanical Properties of Lumber and Wood-Based
Structural Materials[1]



Designation: D1990 – 19

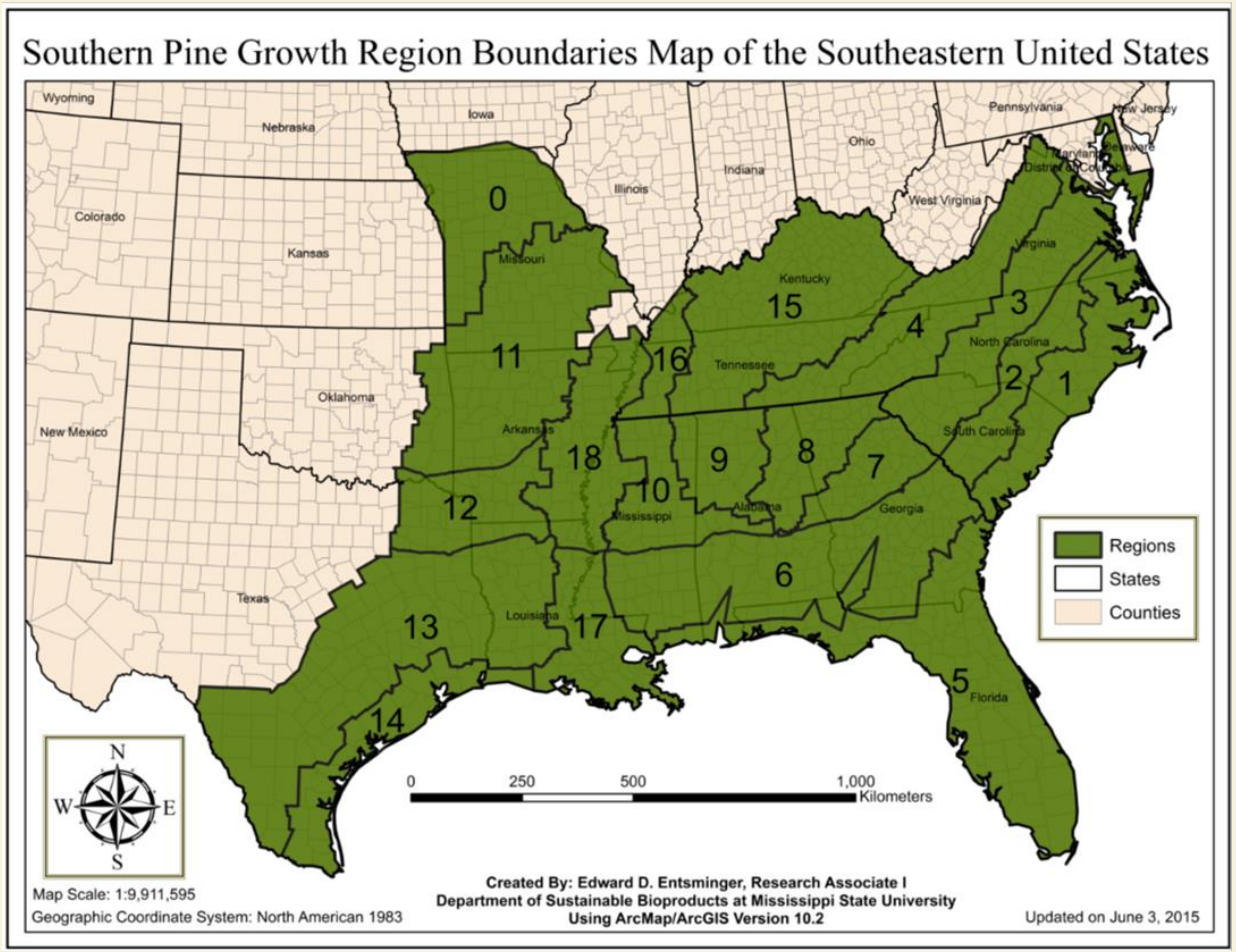
Standard Practice for
Establishing Allowable Properties for Visually-Graded
Dimension Lumber from In-Grade Tests of Full-Size
Specimens[1]

In-Grade Testing

- Two Grades: SS and #2
- Three Sizes: 2x4, 2x8, 2x10
- Four Properties
  - Bending (MOR, MOE), Tension, Compression Parallel
- Models used to develop Dimension Lumber Design Values for all sizes and NGR grades
- Shear, Compression Perp use small, clear data

Sampling

- Mills assigned to one of 16 homogeneous Southern Pine growing regions
- Included SPIB and TP mills
- Randomly select mills in proportion to regional production
- Target sample size: 360 pieces per “cell”
- Test 10 piece “lots” from each selected mill

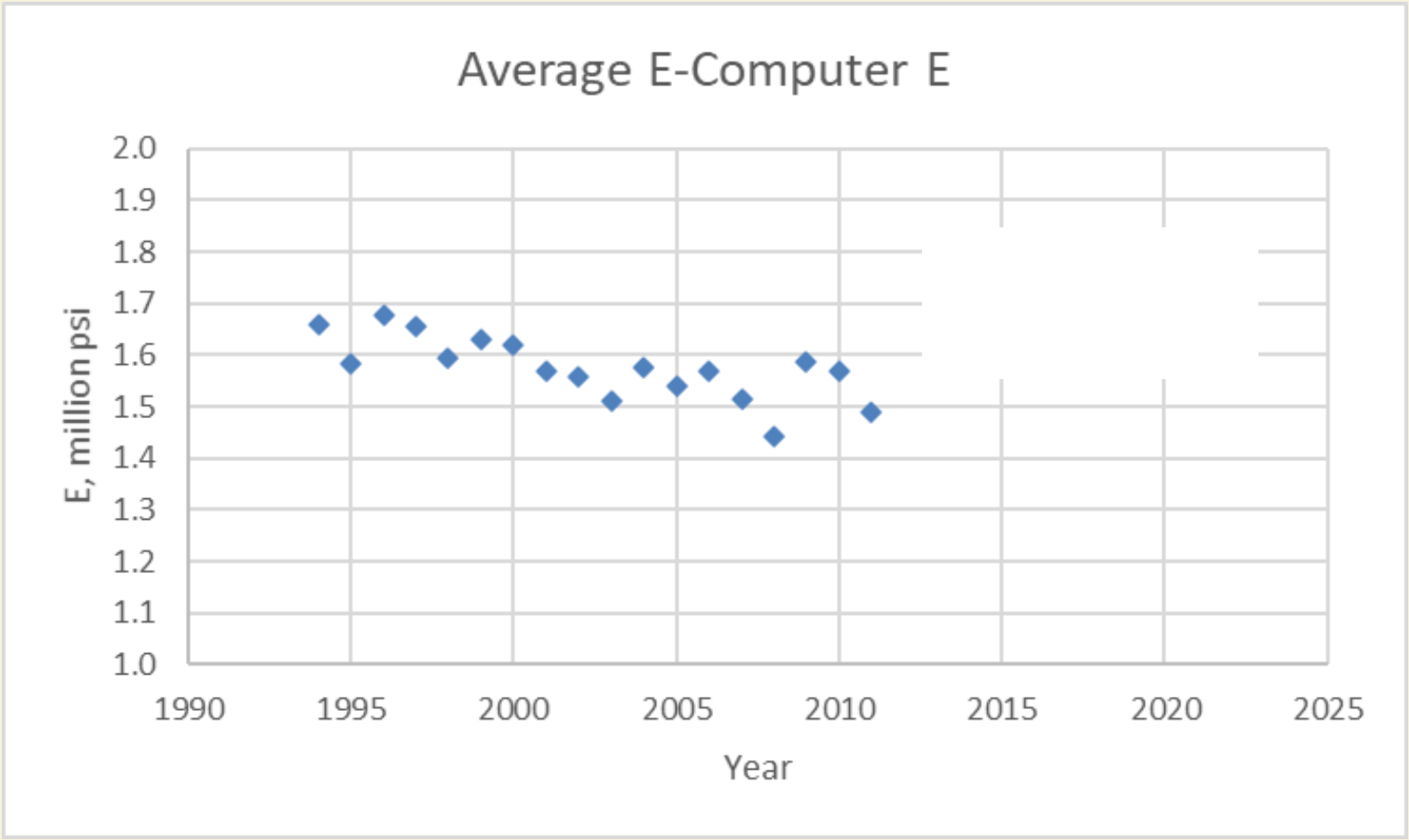

Southern Pine Growth Region Boundaries Map of the Southeastern United States
Wyoming
Nebraska
Iowa
Illinois
Indiana
Ohio
Pennsylvania
New Jersey
Colorado
Kansas
Missouri
Kentucky
West Virginia
Virginia
Oklahoma
Tennessee
North Carolina
New Mexico
Arkansas
South Carolina
Mississippi
Alabama
Georgia
Texas
Louisiana
Florida
0
11
16
15
4
3
2
1
18
9
8
7
10
12
6
13
17
5
14
Regions
States
Counties
N
W
E
S
0
250
500
1,000
Kilometers
Map Scale: 1:9,911,595
Geographic Coordinate System: North American 1983
Created By: Edward D. Entsminger, Research Associate I
Department of Sustainable Bioproducts at Mississippi State University
Using ArcMap/ArcGIS Version 10.2
Updated on June 3, 2015

In-Grade Design Values

- Adopted in 1991
- Each width has own values
- No Increase for KD15
- Continued higher values for Dense
- Required creation of “Non-Dense” Grades

Initial Monitoring

- From 1994-2010, a non-destructive monitoring program was conducted by SPIB
- Portable E-Computer was used at mill sites to collect data
- Tested #2 2x4 – useful to detect trends over time


Average E-Computer E
E, million psi
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
1990
1995
2000
2005
2010
2015
2020
2025
Year

Initial Monitoring

- Observed downward trend over time
- Other anecdotal evidence suggested issues
- Destructive Testing: 2011
  - #2 2x4
  - MOE, MOR, UTS
- Significant decreases observed

“New” In-Grade Testing

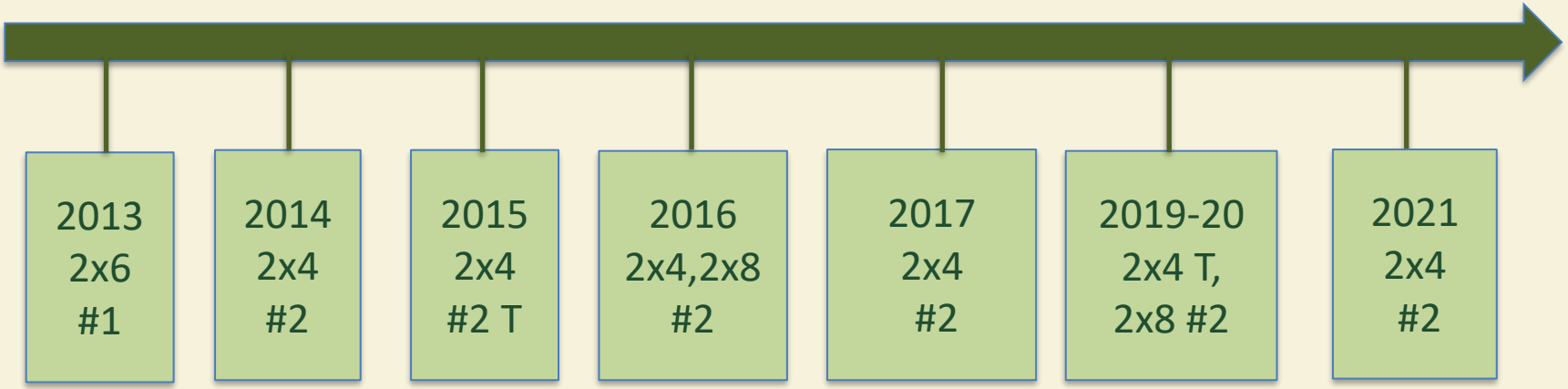
- Conducted in 2012
- Two Grades
- Three Sizes
- Four Properties
- Same modeling to develop Dimension Lumber Design Values
- New Values published in 2013

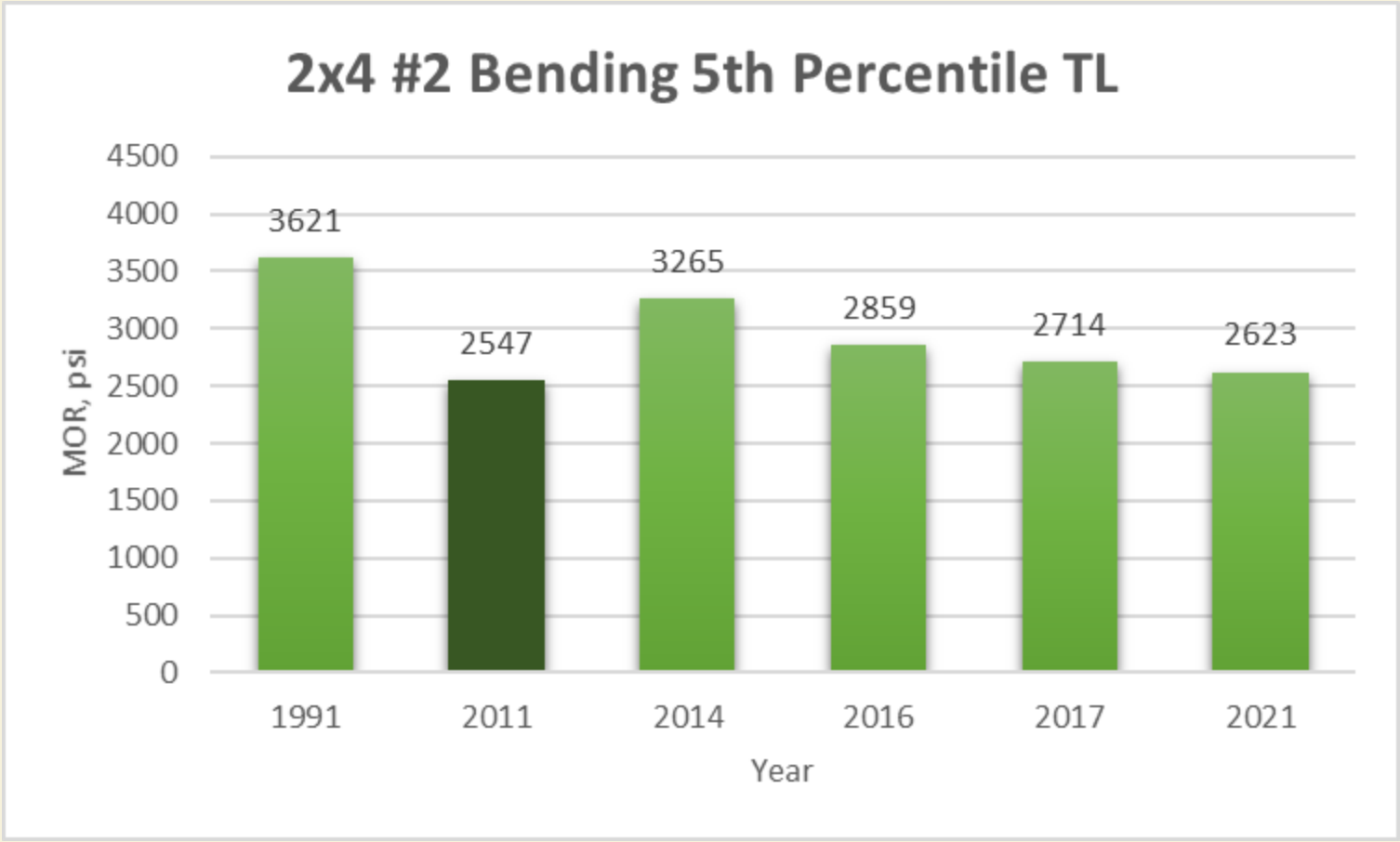
Current Monitoring Program

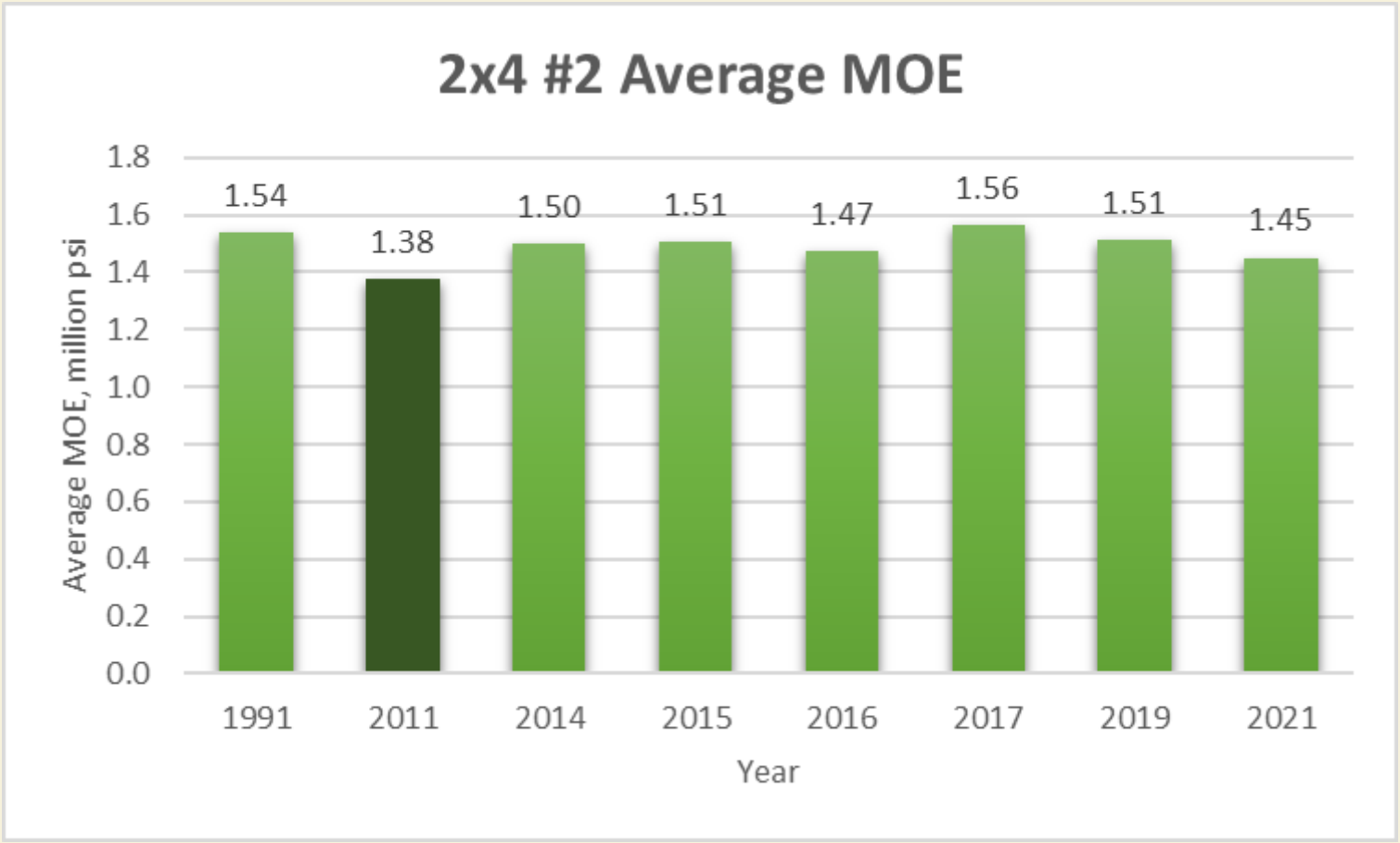
- Destructive tests
- #2 2x4
- Required at least every 5 years
- Follows In-Grade sample selection protocol
- Regions sampled proportional to production
- Mills selected randomly

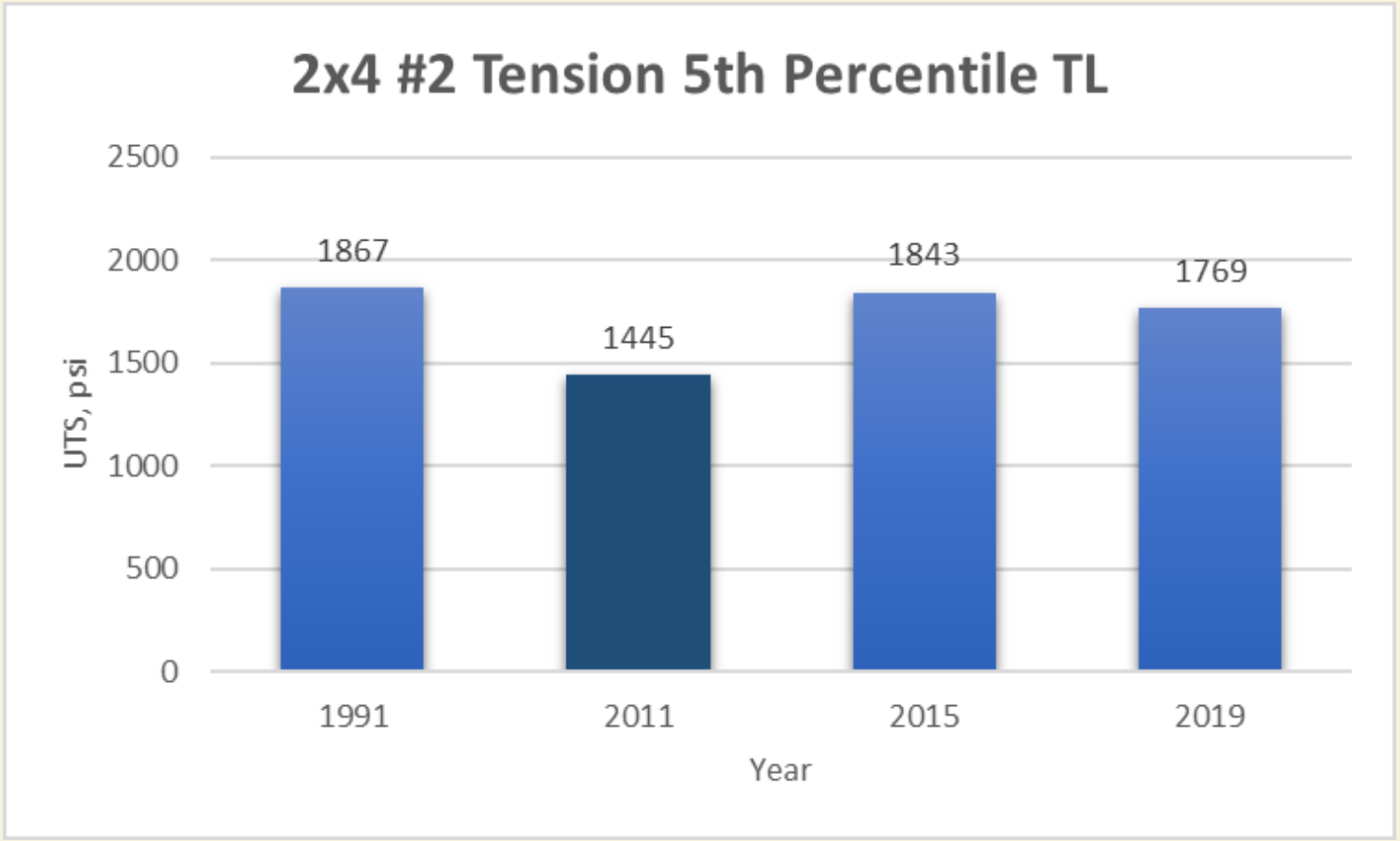
2013-2020

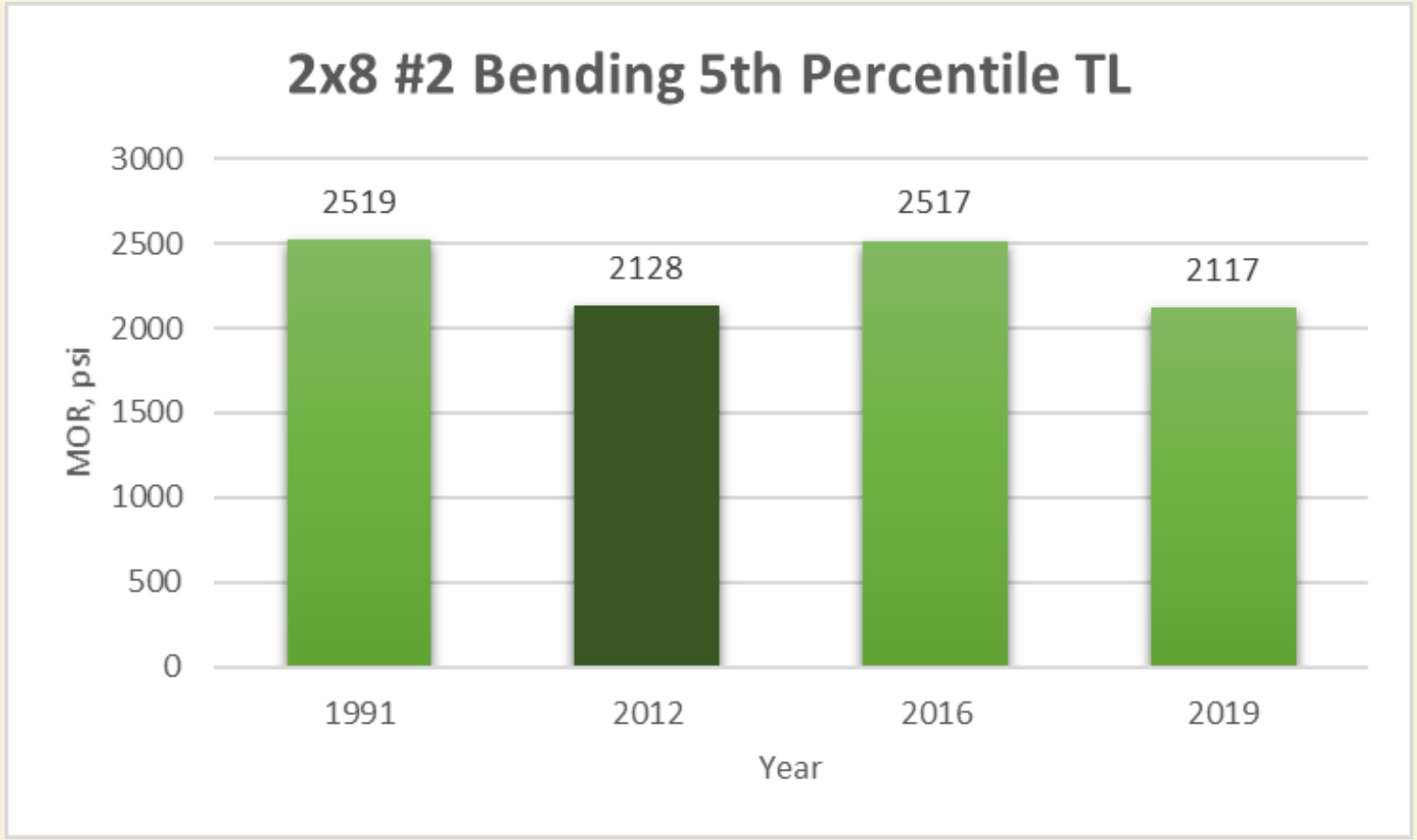
- Variety of sizes
- Bending or Tension Tests

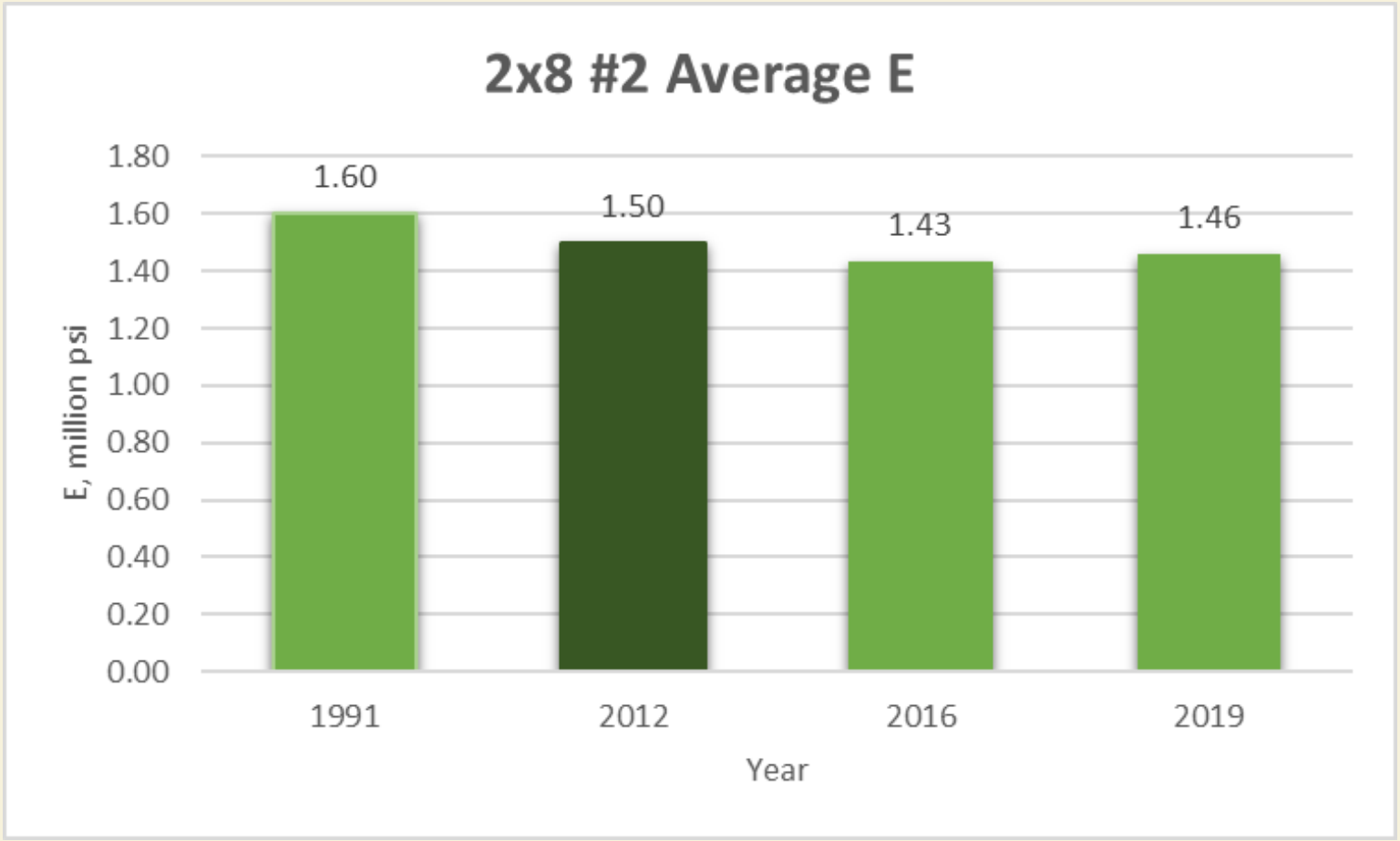



2x4 #2 Bending 5th Percentile TL
MOR, psi
4500
4000
3500
3000
2500
2000
1500
1000
500
0
3621
2547
3265
2859
2714
2623
1991
2011
2014
2016
2017
2021
Year


2x4 #2 Average MOE
Average MOE, million psi
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1.54
1.38
1.50
1.51
1.47
1.56
1.51
1.45
1991
2011
2014
2015
2016
2017
2019
2021
Year


2x4 #2 Tension 5th Percentile TL
2500
2000
1500
1000
500
0
UTS, psi
1867
1445
1843
1769
1991
2011
2015
2019
Year


2x8 #2 Bending 5th Percentile TL
3000
2500
2000
1500
1000
500
0
MOR, psi
2519
2128
2517
2117
1991
2012
2016
2019
Year


2x8 #2 Average E
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
E, million psi
1.60
1.50
1.43
1.46
1991
2012
2016
2019
Year

Observations

- 2011 Samples were drier and had more combination knots
- Present design values represent lower end of what could be included in the grade
- Recent results support the current design values

Future Monitoring

- Test 2x4 #2 about every 18 months
- Test 2x8 #2 every 3 years

Thank
You